MEMORANDA.

FARM EXPERIMENTS.

BY J. W. SANBORN, SUPERINTENDENT.

COLLEGE FARM, HANOVER, Feb. 9, 1878.

To the Secretary of the Board of Agriculture:

In accordance with your suggestion, I forward some of the first results of experimental work at the College farm and *quasi* experimental station. Experimental work, to become authority in practice, requires, among other elements, that of time; and those commenced will be pursued with careful accuracy. Costly inquiry into abstruse and theoretical questions in the science of agriculture, have not been undertaken, as means are not afforded. Matters that have relation to daily practice in farming have been and are being investigated both in relation to the culture of plants and the feeding of animals.

The success of experimental stations in Europe, and the great good they have accomplished in the facts that have been diffused among the farmers by them, have induced a very general and increasing belief that some such work in New England, where the farmer has so much to contend with, would result in better methods, and that facts which have been fairly and clearly arrived at, would now, under similar circumstances or conditions, be gladly accepted. With this belief, we have experimented in those departments in which facilities were at hand.

EFFECTS OF TEMPERATURE.

As an economic question to the farmer, the relation of temperature to animal production and consumption is being investigated. A steady and prolonged period of cold weather would undoubtedly have an effect in regard to the amount of food consumed; but, after long weighing daily, we cannot find that the fluctuations of temperature for short periods of time, in winter, change materially the amount of food consumed. A change in production is seen quickly.

January 4th, 5th, and 6th, 1877, average temperature outdoors, 13° below zero, gave 3.4 per cent. less milk than the next three days, with mean temperature 11° above zero.

January 10 to 18,—yield, 265 quarts of milk; average temperature, 2° below.

January 30 to February 7,—yield, 287 quarts, or 8.3 per cent. increase for the same number of days, temperature 21° above zero.

The average for January, 2.5° above; for February, 12° above.

Average yield per lot of cows experimented with, per day, for January, 64.3 lbs.; for February, 70.1 lbs., or 9 per cent. more for February.

Cows calved in early fall.

A record of temperature in the barn was made, and results reported for winter of 1877–8 as follows:

Dec. 26 to 30, 1877,—yield, 240 lbs.; temperature, 4° above freezing point.

Jan. 1 to 5, 1878,—yield, 242 lbs.; temperature, 7° below freezing point; gain per day, .0021 per cent.

The cows, for a period of 38 days, were making a daily increase of about .46 per cent. over each previous day's milking, or 17 per cent. for 37 days. Thus, for 4 days, there was an actual loss of 1.26 per cent. over their previous milking capacity.

Jan. 6 to 10,—yield, 258 lbs.; temperature, 21° below the freezing point.

Jan. 11 to 15,—yield, 277 lbs.; temperature, 4° above freezing point; gain, 5.3 per cent.

Subject to the modification as before :

Jan. 18 to 28,—yield, 880 lbs. ; temperature, 1° above the freezing point.

Jan. 29 to Feb. 7,—yield, 800 lbs. ; temperature, 10° below the freezing point ; loss, 10 per cent.

We will not as yet give any figures on the effect of temperature on beef production. It will be noticed that the number of degrees of change, other things being equal, determine the change in production ; but this is very greatly modified by the length of the period of heat or cold following a change of weather. We hope to obtain an approximation of the relation of the two to the modification of production. These figures are given to show that there is a profit in warm barns. The barn is in part lined with heavy paper, and clapboarded.

Farmers with open barns can make their own deductions, and figure out the profit of investment in arrangements for warm stables.

RELATIVE VALUES OF FOOD.

The relative values of corn meal, bran, middlings, cotton-seed meal, for milk and butter, have been put to the test as follows :

Four cows, calving at near periods, were fed in January, on bran and meal, mixed, their milk record kept, and their producing capacity noted on same food. In February, they were divided into two lots, of two cows each.

Lot 1 was found to have given for January, per day, $34\frac{3}{11}$ lbs. milk.

Lot 2 was found to have given for January, per day, $29\frac{10}{16}$ lbs. milk.

Lot 1 yielded for February, per day, $37\frac{5}{16}$ lbs. milk.

Lot 2 yielded for February, per day, $32\frac{9}{16}$ lbs. milk.

Lot 2 gained per day .07 more than Lot 1.

Lot 1 was fed on 6 lbs. per day for first 16 days.

Lot 2 was fed on 6 lbs. corn meal for entire month.

Last 12 days, Lot 1 was fed on bran, that would afford as much digestible matter as 6 lbs. meal, or $8\frac{1}{5}$ lbs. bran, per day.

Lot 1, for last 12 days of February, $36\frac{1}{2}$ lbs. per day.

Lot 2, for last 12 days of February, $32\frac{9}{16}$ lbs. per day.

Lot 2 gained .04 of 1 per cent. more for this period than Lot 1.

Last two weeks of February, Lot 1, from 138$\frac{3}{8}$ lbs. milk, made 4 lbs. 2$\frac{1}{2}$ oz. butter.

Same period for Lot 2 gave, from 116$\frac{1}{8}$ lbs. milk, 3 lbs. 15$\frac{1}{2}$ oz. butter.

Lot 1 weighed, February 1, 1,980 lbs.

Lot 1 weighed, March 1, 1,957 lbs.

Lot 2 weighed, February 1, 1,995 lbs.

Lot 2 weighed, March 1, 2,024 lbs.

This gain and loss of weight will be noted in the result.

The food was reversed for March. The cows that had corn meal for February, were fed on bran for March,—Lot 1 on corn meal, and Lot 2 on bran:

Yield of Lot 1 for March, 36$\frac{11}{31}$ lbs. milk per day.

Yield of Lot 2 for March, 31$\frac{16}{31}$ lbs. milk per day.

Lot 2 lost .05 more than Lot 1.

Lot 1 made, from 175$\frac{5}{16}$ lbs. milk, 6$\frac{1}{4}$ lbs. butter.

Lot 2 made, from 178$\frac{1}{4}$ lbs. milk, 6$\frac{1}{4}$ lbs. butter.

Weight of Lot 1, April 3, 2,056 lbs.

Weight of Lot 2, April 3, 2,117 lbs.

Weight of Lot 1, March 3, 1,900 lbs.

Weight of Lot 2, March 3, 2,024 lbs.

That the comparative effect of the two foods on the butter product may be seen, I will give the amount of milk required under the changes to make 1 lb. of butter:

Lot 1 for February, on bran, required 33.2 oz. milk to make 1 oz. butter.

Lot 1 for March, on meal, required 28.05 oz. milk to make 1 oz. butter.

Lot 2 for February, on meal, required 29.2 oz. milk to make 1 oz. butter.

Lot 2 for March, on bran, required 32.4 oz. milk to make 1 oz. butter.

As these cows were well and hearty during the three months they were fed, milk being weighed night and morning, and everything about the experiment being done with care, the figures reversing themselves throughout with the food, we consider that they indicate quite thoroughly that corn meal is the better food of the two for the dairy cow,—at least, in moderate amounts, fed with ordinary stock hay in the winter season.

Another question that would be partly answered by these feeding experiments is, whether the two foods mixed would not be better than corn meal, or either alone. The four cows, or both lots, were fed on bran and corn, mixed, for January, the first month of the experiment; and the results do not indicate such to be the fact,—at least, when fed in connection with hay.

I will state that the first two weeks of March, the lot fed on bran had six pounds, being the same number of ponnds as that of the lot fed on corn meal; but for the last half of the month the bran was increased to $8\frac{1}{2}$ lbs.

The composition of bran and middlings being somewhat unlike, and very different in mechanical preparation, middlings were used in the winter of 1878, against corn meal, hoping for better results than from bran:

Lot 1,—yield per day for 18 days, before commencing experiments, 23 lbs.

Lot 2,—yield per day for 18 days, before commencing experiments, $26\frac{17}{18}$ lbs.

Lot 3,—yield per day for 18 days before commencing experiments, $22\frac{10}{18}$ lbs.

Weight Lot 1, 1,801 lbs.

Weight Lot 2, 2,024 lbs.

Weight Lot 3, 1,950 lbs.

Lot 1,—18 days on meal, 6 lbs. per day, gave $25\frac{13}{18}$ lbs. milk.

Lot 2,—18 days on middlings, 6 lbs. per day, gave $28\frac{8}{18}$ lbs. milk.

Lot 3,—18 days on meal and turnips, 6 lbs. meal and 1 peck turnips per day, gave 25 lbs. milk.

Equal quantities by weight were given, Lot 3 having the turnips in addition.

The gain per cent. of milk for the first period was:

Lot 1, 11.8 per cent.

Lot 2, 5.5 per cent.

Lot 3, 6.4 per cent.

Weight Lot 1, 1,737 lbs.; loss, 62 lbs.
Weight Lot 2, 1,980 lbs.; loss, 44 lbs.
Weight Lot 3, 1,821 lbs.; loss, 139 lbs.

Reversed food:

Lot 1,—middlings, 20 days; yield, 29½ lbs.
Lot 2,—meal, 20 days; yield, 29½ lbs.
Lot 3,—meal and turnips, 20 days; yield, 27.7 lbs.
Gain per cent.,—Lot 1, 14.4.
Gain per cent.,—Lot 2, 3.6.
Gain per cent.,—Lot 3, 10.4.

Last half of this period Lot 3 had middlings, and the gain is partly due to this change.

A careful analysis of these figures will show that middlings made a little over two per cent. more milk than meal. It will be noticed that Lot 1 made very much more gain than Lot 2 on either food. It was due to the fact that Lot 2 had in it a cow not the best. She made no gain in flow,—the gain being made by her mate in the experiment. These poor cows do not respond to increase of food as readily as good cows. These figures are better than a sermon for good cows:

Weight of cows on change of food—Lot 1, 1,730 pounds.
" " 2, 1,920 "
" " 3, 1,810 "

Thus, the middlings have maintained the weight of our animals the best of the three foods, while the turnips have made a poor showing for milk and the condition of the cows.

The milk was set in per cent. glasses at each change of food. There was such a remarkable change of the amount of cream recorded, which resulted simply from a slight change of temperature, that I cannot give exact figures; but the corn meal gave a decidedly better showing for cream than the middlings, though not the difference that was seen between the corn meal and bran. The cream would not be a sure indication of the butter product. The cream was churned in the experiment of corn meal and bran.

Rowen was fed, with results as follows:

Our cows are fed eight rations daily, two of which are ground feed. The substitution of a foddering of rowen morning and evening for English hay gave a quick increase of eight per cent. of milk. A month's feeding in the fall of corn meal, fodder-corn, and rowen, made a good showing for the rowen.

Lot 1 gave 36 per cent. of total yield; Lot 2, 35 per cent.; and Lot 3, 29 per cent., all on the same feed. In the experiment, Lot 1 had meal, Lot 2 fodder-corn, and Lot 3 rowen.

Thirty days' feeding gave the following results:

Lot 1 gave 37.1 per cent., Lot 2, 33.4 per cent., and Lot 3, 29.5 per cent. of total yield. The corn-fodder was sweet corn-fodder, cut late.

Thus far, in moderate quantities in cold weather, corn meal has compared very favorably for milk production with other foods given, being excelled only by middlings.

Experiments at present in progress appear to be adverse to bran as food for the milk and butter cow, or for milk alone, as before.

SETTING MILK.

The "close or covered system of setting milk" is a wide departure from old principles and practices. This and the "deep settings" have been tested together.

In practice, the butter sells as readily, and I think is preferred by my customers to that made from open pans. If there is a volatile oil (giving rise to animal odors) retained by the covered milk by this system, as many claim there will be, it does not, in practice, affect its quality, unless it is in the keeping. I cannot speak from experience on that point.

Among its advantages, I may name saving of labor, exclusion of atmospheric impurities, retention of the volatile flavoring oils of milk, sweet milk for calves, economy in winter, and uniformity in product. The one great disadvantage is, cost of ice in summer. We have used thirty-five pounds daily, costing a little over fourteen cents, and have made about five pounds of butter daily. Cost of ice per pound of butter in round numbers, three cents. As our ice has cost nearly three times as much as it ordinarily would for farmers to gather their own, it would seem that it could be afforded, if it aided in making a higher grade of butter in hot weather. Eight months of the year it would not be required. Deep setting would evidently have a decided advantage over shallow setting for winter. We use Hardin's closets, where the milk nearly freezes in the coldest of weather.

Low temperature being absolutely essential for deep setting, the weather of winter is favorable, while a high temperature is desirable for shallow setting, and is obtained only at much cost in winter.

Our cans are eight inches in diameter, and twenty inches deep. We give a few results:

Dec. 17. Milk froze solid; $196\frac{1}{2}$ quarts gave $17\frac{3}{8}$ pounds butter, or, 11.3 quarts to one pound of butter; pans used.

Dec. 26. Temperature from 30° to 40°; $233\frac{1}{2}$ quarts of milk gave $19\frac{7}{8}$ pounds of butter, or, 11.7 quarts of milk made one pound of butter; pans.

Jan. 2. $118\frac{1}{2}$ quarts gave $10\frac{1}{2}$ pounds of butter, or, 11.2 quarts to one pound of butter; temperature from 45° to 60°; deep cans.

April 11. 112 quarts, in deep cans without ice, gave $8\frac{13}{16}$ pounds butter.

April 11. 112 quarts in pans gave $8\frac{10}{16}$ pounds butter; temperature of both, same; or, from 40° to 55°.

In the above experiment, April 11, milk mixed and divided by measure, as were the following two:

June 11. $104\frac{1}{2}$ quarts milk, by deep cans (iced), gave $11\frac{1}{16}$ pounds butter.

June 11. $104\frac{1}{2}$ quarts milk, by pans, gave $11\frac{7}{16}$ pounds butter; temperature of cans, 49°; pans, 60° to 70°.

July 17. 102 quarts, by deep cans, gave $9\frac{3}{16}$ pounds butter.

July 17. 102 quarts, by pans, gave $9\frac{14}{16}$ pounds butter; temperature of cans, 49°; pans, 60° to 70°.

July 20. Set seventy-five quarts by each method, and, wishing for exact work, I divided the milk of each can by the scales, noticing that on April 11 the deep setting had given the best result, and subsequently it had not. Believing in the reign of law, I determined to get a lower temperature for the deep cans, and so mixed salt with the ice, and carried the temperature down to from 42° to 45°, and from 78 quarts (deep cans) got $7\frac{1}{16}$ pounds butter; from 78 quarts, by pans, got $6\frac{4}{16}$ pounds of butter; temperature by pans, 65° to 80°. The increased elevation of temperature of milk in pans decreased the amount of butter, and the lower temperature of milk in the deep cans gave an increased amount of butter per quart of milk.

February, 1878. 82 quarts were set by deep cans; temperature from 32° to 40°; butter, $5\frac{6}{16}$ pounds.

February, 1878. 82 quarts were set by pans; temperature, 50° to 62°; butter, $5\frac{6}{16}$ pounds. Low butter yield due to bran and special causes in experiment.

The influence of temperature will be noticed on the result under different depths of setting.

At a uniform depth of setting, under changing temperatures, we obtain very marked differences of product.

Thus, in our per cent. glass, about eight inches deep, we get the following results from milk of same cow, using two glasses, that both lots may be set from the same milking:

First Glass.						Second Glass.					
Hours..............	6	12	24	36	48	Hours..............	6	12	24	36	48
Temperature.......	30°	45°	30°	35°	30°	Temperature.......	55°	55°	45°	58°	47°
Cream (per cent.)..	20	20	19	17	16	Cream (per cent.)...	12	12	12	12	12
Hours..............	6	24				Hours..............	6	24			
Temperature.......	38°	32°				Temperature.......	60°	65°			
Cream (per cent.)...	19	17				Cream (per cent.)...	5	10			

Aside from the necessity of regulating depth and temperature in relation to each other, there has been noticed quite generally, in many cases, that where cream is raised by a low temperature, it diminishes in bulk by standing on the milk, as is noticed by the figures given:

Thus, in 6 hours, all the cream had risen that was made apparent in our narrow and deep per cent. glasses.

In water, at 32°, more cream was observed at the end of 4 hours—21 per cent.—than was noticed after; it then declined to $17\frac{1}{2}$ per cent. at the end of 24 hours.

There is, in our herd of cows, an Ayrshire cow, that shows but 3 per cent. of cream; also a Jersey, that shows 24 per cent.

This difference is so marked, that I mention it. It serves to illustrate the oft stated fact, that the amount of milk is no guide to the value of a cow for ordinary dairy purposes. Both are thoroughbreds.

PER CENT. OF FOOD CONSUMED BY NEAT STOCK DAILY.

It would seem to be desirable to have American percentages of food consumed by live weight daily, instead of German results, of doubtful application here, whose general statement is 3 per cent. of live weight daily of hay.

The per cent. consumed daily will depend both upon breed and age. The relation of breed to amount of food consumed is now under investigation.

Twelve cows—9 in milk, 3 forward with calf—consumed in 14 days, 3,590 lbs. hay, 350 lbs. meal, and 266 lbs. of bran; weight of stock, 11,960 lbs.; per cent. of live weight consumed daily 2.63; gain of stock, 137 lbs. The grain was estimated in its equivalent of hay, and added to it.

Two calves; weight, 598 lbs.; age, 4 months; fed hay alone; time, 45 days; fed, 917 lbs.; per cent. of live weight daily, 3.5 lbs.; hay to make 1 lb. of growth, 7.7 lbs.

Six calves; fed, 21 days, 1,340 lbs. hay; gain, 111 lbs.; to make 1 lb. growth, 12 lbs. hay; age of calves, 8 months; per cent. of live weight daily, 2.8.

Fed 3 two-year-old steers 82 days; consumed 5,065 lbs.; per cent. of live weight daily, 1.9; gain, 136 lbs.

Thus they gained about ½ lb. each daily on less food than the Germans have found necessary to maintain existence without gain or loss. Is the quality of our hay better than theirs? or is our stock better calculated to appropriate to growth the food consumed?

The food given these steers was coarse Herd's-grass, and not relished. By mixing fine hay with it, they would consume 10 lbs. more per day, and make a very much more rapid growth. This last 10 lbs. thus consumed made much more growth than the first 60 lbs. given.

Two three-year-old steers consumed, in 30 days, 1,636 lbs. of hay; per cent. of daily consumption, 2.2 of live weight; amount of hay to make 1 lb. growth, 17.4 lbs.; gain of steers, 94 lbs., or 1.56 lbs. each daily.

By consuming .3 of 1 per cent., or 3 lbs. of hay more per day for every 1,000 lbs. of animal weight, these three-year-old steers have gained per day more than three times as much as the two-year-old steers, the two-year-old steers being larger per cent. and more thrifty of their age. The small calves have eaten 3.5 of live weight daily, and the three-year-old steers only 2.2 per cent. daily ; and the calves have made 1 lb. of growth for 7.7 lbs. of hay, and the three-year-old steers have required 17.4 lbs. to make 1 lb. of growth. Then it is large consumption that means rapid and cheap growth.

On pigs and cattle both, I find that young animals consume, in proportion to weight, more than old ones, and grow faster. As an animal increases in age or size, the more food is required to make 1 lb. of growth.

For the winter of 1877–8, I find our two-year-old steers are consuming 2.5 per cent. of live weight daily, and are gaining 1¼ lbs. daily on the feed, being hay that was damaged by rain.

Our year-old steers are consuming, thus far, 2.75 per cent. daily of their live weight.

It required 12 lbs. of hay, very nearly, for our calves and three-years-old steers, fed together,—and they will represent the average age of young stock kept in New Hampshire,—to make 1 lb. of growth. At $12 per ton, 1 lb. of winter growth, under favorable circumstances, would cost 7.2 cents.

Now consider the cost of summer growth :

Six steers, sold in July, had gained 120 lbs. each ; cost per lb., 1.6 cents.

Six steers, sold in October, had gained 220 lbs. each ; cost per lb., 1.3 cents.

Winter growth only pays in connection with summer growth. The policy of fattening stock in winter is usually a bad one, and one that belongs to the past. To sell growing stock in the spring is also poor policy.

COMPLEMENTARY FOODS.

Scientists state that coarse food, like straw, corn-stalks, poor hay, &c., contains an excess of carbo-hydrates, or the elements that maintain respiration, and in a measure supply fattening materials, while they lack in the materials that make flesh and bones—albuminoids; that bran, cotton-seed meal, oil cake, &c., contain an excess of the latter, and a low per cent. of the former material, and that by putting the two classes of food together in feeding, more of each of the elements will be utilized, if rightly combined, and a cheaper food thus furnished.

A series of experiments has been undertaken which must be of long duration to test this matter.

Three lots of thrifty two-year-old steers were weighed.

Lot 1,—weight, 2,937 lbs. Fed average quality of hay—not best.

Lot 2,—weight, 2,929 lbs. Fed bran and straw.

Lot 3,—weight, 3,115 lbs. Fed cotton-seed meal.

Without giving the several weighings, and the varying amounts of food, I will state totals for a month's feeding, with calculations of digestible matter consumed:

Weight of Lot 1, at end of month, 2,992 lbs.

Weight of Lot 2, at end of month, 2,967 lbs.

Weight of Lot 3, at end of month, 3,198 lbs.

Lot 1 consumed, hay, 1,910 lbs.

Lot 2 consumed, straw, 1,091 lbs.; bran, 714 lbs.

Lot 3 consumed, straw, 1,393 lbs.; cotton-seed meal, 384 lbs.

	Albuminoids.	Carbo-hydrates.	Fat.
Lot 1 consumed of digestible,	122.24 lbs.	890 lbs.	18.14 lbs.
Lot 2 consumed in straw,	14.18	408	6 54
Lot 2 consumed in bran,	77.82	268.46	24.27
Lot 3 consumed in straw,	18.10	520.98	8.3
Lot 3 consumed in cotton-seed meal,	110.59	65.28	38 01

Cost of food, estimating hay at what I suppose might be an average price for the state:

Lot 1, for 28 days, $14.62.

Lot 2, for 28 days, $11.28. Straw, $5 per ton; bran, $24 per ton.

Lot 3, for 28 days, $10.55.

The pounds consumed, given, were for 32 days in Lot 3.

At the close of one month's feeding,—they were all fed alike on hay—poor coarse hay, for 20 days,—Lot 1 gained but 5 lbs., while Lot 3 gained 74 lbs, showing that the effect of the concentrated food was to lessen the amount of offal, and that the weight given by the scales did not represent the true gain of the lots fed on grain.

In continuation of these same experiments, four lots of steers have been weighed, and will be fed during the entire winter of 1878, one out of each lot being carded, and weight kept; also, one lot, as were the cows, will be fed on roots. We wish to ascertain the value of roots in farm economy in this country.

The steers were all of one age—2 years old—and size, and all thrifty—2 in each lot:

Lot 1,—weight, 2,050 lbs ; feed, hay.

Lot 2,—weight, 2,062 lbs. ; feed, hay and turnips—1 peck each of turnips daily.

Lot 3,—weight, 2,037 lbs. ; feed, corn-fodder and corn meal, 16 lbs.

Lot 4,—weight, 2,071 lbs. ; feed, corn-fodder, bran, and cotton-seed meal, 15 lbs.

The bran and cotton-seed meal were estimated to furnish as much albuminoids as would be found in the hay.

The meal was fed to ascertain whether the results were due to albuminoids in bran and cotton-seed, or to the mere fact that they were a rich food, or, in short, to compare the value of the two classes of food to feed with coarse fodder.

December 24,—

Lot 1 weighed 2,067 lbs.
Lot 2 weighed 2,170 lbs.
Lot 3 weighed 1,996 lbs.
Lot 4 weighed 2,066 lbs.

January 7,—

Lot 1 weighed 2,133 lbs.
Lot 2 weighed 2,187 lbs.
Lot 3 weighed 2,045 lbs.
Lot 4 weighed 2,126 lbs.

One of each lot carded after January 7.

January 21,—

Lot 1 weighed 2,172 lbs.
Lot 2 weighed 2,232 lbs.
Lot 3 weighed 2,084 lbs.
Lot 4 weighed 2,149 lbs.

February 1,—

Lot 1 weighed 2,165 lbs.
Lot 2 weighed 2,222 lbs.
Lot 3 weighed 2,095 lbs.
Lot 4 weighed 2,202 lbs.

The first effect of turnips was a wonderful growth. The results since have been disappointing.

Lot 2 consumed nearly 5 lbs. of hay less each day.

The first weighing gave a loss for those fed on corn-fodder and concentrated food. Since the first weighing the gain has been as follows:

Lot 1, 98 lbs.
Lot 2, 52 lbs.
Lot 3, 99 lbs.
Lot 4, 136 l .

The manure from Lot 4 will be found worth thrice as much as Lot 3.

I will add that Lot 4 ate their coarse fodder better with the albuminous food, than Lot 3 with corn meal or carbonaceous food. The corn meal affords more digestible matter than the bran and cotton-seed meal. We have three months more to feed, after which we will report in full.

We have been somewhat surprised to find that our carded steers, after a month's carding, have not gained as much as the uncarded ones.

PIG FEEDING.

Omitting experiments requiring detailed account for a future time, I will give results of feeding three lots of pigs of one type from a common mother, and weighing, Lot 1, 74 lbs., fed on middlings alone; Lot 2, 72 lbs., fed on skim milk alone; Lot 3, 72 lbs., fed on corn meal alone. Lot 1 and 3 were fed to contrast value of meal and middlings, and Lot 2 to fix a value for skim milk in the dairy account. These will all be continued on an enlarged scale, Lot 2 to have some fatty matter in the milk, to get the full value of the nitrogenous matter of the milk. The pigs were six weeks old.

Consumed.		Gained.	Feed to make one lb. of growth.	Cost per pound growth.	Growth per 100 lbs. feed.
FIRST WEIGHING—28 DAYS.					
Lot 1.	131½ lbs.	32 lbs.	4.1 lbs.	5.1 cts.	24.6 lbs.
3.	174	48	3.6	4.5	27.7
2.	445 qts.	45	9.8 qts.		
SECOND WEIGHING—39 DAYS.					
Lot 1.	215 lbs.	58 lbs.	3.7 lbs.	4.5 cts.	27. lbs.
3.	390	115	3.4	4.25	29.1
2.	1003 qts.	89	11.3 qts.		
THIRD WEIGHING—43 DAYS.					
Lot 1.	290 lbs.	56 lbs.	5.1 lbs.	6.37 cts.	19.6 lbs.
3.	427	100	4.27	5.3	21.2
2.	1580 qts.	106	15 qts.		
FOURTH WEIGHING—26 DAYS.					
Lot 1.	187 lbs.	55 lbs.	3.4 lbs.	4.25 cts.	23.2 lbs.
3.	289	60	4.8	5.82	20.4
Meal and middlings in place of milk.					
2.	230	46	5	6.25	20
FIFTH WEIGHING—30 DAYS.					
Lot 1.	342 lbs.	97 lbs.	3.5 lbs.	4.6 cts.	28.6 lbs.
3.	285	75	3.8	4.75	26.2
2.	342	107	3.2	4	31.3

Lot 1, dressed weight, 289 lbs.; shrinkage, 22.3 per cent.
Lot 2, dressed weight, 371 lbs.; shrinkage, 18.6 per cent.
Lot 3, dressed weight, 387 lbs.; shrinkage, 20.2 per cent.

The skim milk did not yield quite half a cent per quart return. We hope to show it to be worth more by the use of proper food with it. The growth by meal or middlings did not cost quite five cents per pound live weight, while it would have sold for five and a half cents. In relation to growth, those on middlings had a tendency to grow what is termed coarser than those on meal, and had to be fattened off on meal.

A pig each of Lots 1 and 3 got injured, the pig of Lot 3 suffering most. That accounts for the fluctuation in amount of food required at the beginning of the experiment to make a pound of growth.

There are several things of interest to me in the experiment that suggest further inquiry. It is my place to give the facts, but I forbear to analyze them. I would ask, however, Why did Lot 3 consume so much more food than Lot 1, and yet make no more growth per pound of food consumed? The reason seems apparent, and opens a field for investigation that may be of utility.

Last weighing of Lot 2 gave 17½ lbs. increase for a bushel of corn.

FIELD EXPERIMENTS.

Field experiments have been carried on in the method of using seed potatoes, curing of corn, application of manures, and other processes, which will require several seasons for completion.

One experiment on a potato-field will be given. It will show no marked result in total yield, being a very poor soil for potatoes, as will be seen from the *nothing* plat, which gave but twenty-five bushels of potatoes per acre on one end of the piece, and only about twice as much on the other. Most of the plats were 2 x 2½ rods, the nothing plats being only one half as wide; but the result will be given in plats 2 x 2½ rods.

Plat.	Crop,—potatoes—Size of plat, 2 x 2½ rods—Yield given in lbs.	Small.	Table.	Total.	Per cent. increase.
1	Plaster, 17 lbs............Rough	27	61	88	87
2	Sulphate Magnesia, 12½ lbs............	30	48	78	66
3	Nothing............Smooth	27	20	47	
4	Salt, 10 qts............Smooth	20	23	43	8 loss
5	Ashes, 3¾ bush............Nearly all smooth	44	78	122	159
6	Ashes, 3¾ bush., and 2 lbs. Nitrogen, in Dried Blood, very rough	24	29	53	12
7	Stockbridge Combination, 19 lbs. Dried Blood, 11 per ct. Nitrogen, 8 lbs. Bone Black, 16 per ct. Phos. Acid, 9.4 lbs. Sul. Potash, 36 per ct. Potash............Smooth	55	91	146	210
8	Nitrogen, 2 lbs., and Phos. Acid, 1.28 lb............Smooth	48	46	94	100
9	Nothing............	34	26	60	27
10	Phos. Acid, 1.20 lbs., and Potash, 3.38 lbs............	68	89½	157½	234
11	Nitrogen, 2 lbs., and Potash, 3.28............	52	72	124	163
12	Same as Plat 7, with only ½ quantity of Dried Blood............	55	98	153	225
13	Nothing............	50	36	86	82
14	Nitrogen, 3.6 lbs............	48	46	94	100
15	Phos. Acid, 1.28 lb............	42	26	68	45
16	Potash, 3.38 lbs............	41	68	109	131
17	Stockbridge Formula, as prepared by Bowker & Co............	60	99	159	238

Plat 17 did not make as large an increase over the nearest nothing plat as plat 7, both containing the same materials in the same amounts. The chemicals were bought for plat 7, and the manufactured material for plat 17, the chemicals costing 20 per cent. less for plat 7 than the material for plat 17. Plat 12 was treated the same as plat 7, only that one half the quantity of nitrogen was used with as favorable results. Ashes furnish all of the mineral elements of plants. It was thought that, by the addition of nitrogen, a complete manure would be had, practically; yet we find ourselves much surprised to learn that it has actually decreased the crop 147 per cent. What is the reason? The omission of potash cuts the crop down one half in plat 8, or 110 per cent. In plat 10 nitrogen is omitted; yet we get really the largest crop of any plat, relatively. Phosphoric acid is necessary, as is seen by plat 11, where it is wanting, in comparison with plats 10 and 16. Nitrogen is one half the cost of our potato fertilizer nearly, and what have we to show for its use on our potato-plats?

FERTILIZERS ON THE WILSON FARM, GILMANTON.

Upon the same plan, Geo. W. Sanborn, of Gilmanton, on his farm, tried the three elements that enter into the Stockbridge formula. These results are so unlike those on the college farm that I introduce them here. The soil on the college farm is alluvial,—a heavy blue clay. The Wilson farm is a clay-loam hill farm, very much like the majority of hill farms of New Hampshire:

Two rows, 2 lbs. nitrogen, .50 bushel large, .50 bushel small potatoes, equals 1.

One row, nothing, .17 bushel large, .37 bushel small potatoes, multiplied by 2, equals 1.08.

Two rows, 4 lbs. potash, .67 bushel large, .70 bushel small potatoes, equals 1.37.

One row, nothing, .20 bushel large, .33 bushel small potatoes, multiplied by 2, equals 1.06.

Two rows, 2 lbs. nitrogen and 4 lbs. potash, .50 bushel small and .70 bushel large potatoes, equals 1.20.

One row, nothing, .25 bushel large potatoes, .20 bushel small, multiplied by 2, equals .90.

Two rows, 1 lb. phosphoric acid, 1.50 bushel large potatoes, .87 bushel small, equals 2.37.

Two rows, 1 lb. phosphoric acid and 4 lbs. potash, 1.18 bushel large potatoes, .62 bushel small, equals 1.80.

One row, nothing, .37 bushel large potatoes, .25 bushel small, multiplied by 2, equals 1.24.

Two rows, 1 lb. phosphoric acid and 2 lbs. nitrogen, 1.68 bushel large potatoes, 1 bushel small, equals 2.68.

Two rows, nothing, 40 bushel large potatoes, 32 bushel small, equals .72.

Two rows, Stockbridge, bought of Bowker & Co., 1.87 bushel large and .75 bushel small potatoes, equals 2.62.

Nitrogen has accomplished but little here, and has not paid. Will the potato-plant gather all of its nitrogen from the air and soil in its compounds? Phosphoric acid has given a wonderful result alone, and for that crop must have been of much profit. It was potash needed for the crop on the state farm. It is phosphoric acid for the Wilson farm. The nitrogen was for both farms procured in dried blood, the phosphate acid in bone-black, and the potash in muriate of potash. We do not claim maturity for these experiments, but suppose they may be of some benefit to the practical farmer. I trust the time will come when the college farm will have the means to carry on more extended inquiry in a wider, more fruitful, and less explored field. Yet, if farming is to be pursued by correct methods, an aggregation of facts in the direction of our inquiry is needed, that we may lay down general laws for our guidance in pursuit of specific ends. Experimental stations are needed to search out facts, and from them enable us to lay down positive principles, that, under like circumstances, shall always give like results. When agriculture can be guided by well-defined laws instead of vague theories, by facts instead of conjecture, the cost of production will be very much reduced, and the producer and consumer greatly benefited. Investigation into and knowledge of the science of agriculture can do more than work, in any and perhaps all other fields, to emancipate man from the burden of excessive labor, and to aid the world in its grand march toward a higher civilization, and to diffuse more uniformly the comforts and luxuries of life.